
**नलकूप में फिल्टर पैक के रूप में प्रयोग की जाने
वाली सामग्री (बजरी) की विशिष्टि**
(पहला पुनरीक्षण)

**Specification for Material (Gravel)
for Use as Filter Pack in Tubewells**
(First Revision)

65.060.35; 23.100.60

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FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Diamond Core and Waterwell Drilling Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1967 and it was reprinted in 2001 incorporating Amendment No.1.

In this revision, following modifications are made:

- a) Scope has been redefined;
- b) Addition of filter pack grade and its selection; and
- c) Addition of filter pack placement and procedure.

The composition of the committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SPECIFICATION FOR MATERIAL (GRAVEL) FOR USE AS FILTER PACK IN TUBEWELLS

(First Revision)

1 SCOPE

1.1 The standard lays down the requirements for material for use as filter pack material in tubewells as source of water. In filter packed wells the zone immediately around the screen is made more permeable by packing it with specially graded material-filter pack earlier known as gravel pack.

1.2 In filter packed wells, the zone immediately around the well screen is made more permeable by removing some formation material and replacing it with specially graded material. This relatively thin zone separates the screen from the formation material and increases the effective hydraulic diameter of the well. A filter pack is advantageous when the small slot size dictated by natural development limits the transmitting capacity of the screen so that the desired yield cannot be obtained. Use of certain drilling methods such as reverse rotary, the borehole diameter cannot be less than 400 mm which is much more than required for installation of the screen and hence filter pack is required to be placed in the annular space. In fine grained uniform sand, friable sand stone, extensively laminated formation (thin layers of fine, medium and coarse sediments), a filter pack is always recommended to get sand free yields.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below:

<i>IS No.</i>	<i>Title</i>
1811 : 1984	Methods of sampling foundry sands (first revision)

3 PHYSICAL CHARACTERISTICS

3.1 The filter pack material selected for packing tubewells shall consist of hard quartz (about 90-95 percent silicon dioxide (SiO_2)) or other suitable material with an average specific gravity of not less

than 2.5. Not more than 10 percent by weight of the material shall have specific gravity of less than 2.25. The pack material shall not contain more than 5 percent by weight of calcareous material. The pack material shall contain no more than 2 percent by weight of thin flat or elongated pieces. The larger dimension shall not be more than 3 times the smallest dimension. The pack material shall be of sub rounded to rounded grains with least angular features.

3.2 The material for use as filter pack shall be free from impurities such as shale, mica, feldspar, clay, dirt, loam, haematite, organic material etc.

4 POROSITY

The filter pack material should be well sorted to assure good porosity and hydraulic conductivity of the material near the screen.

5 FILTER PACK GRADE

5.1 The filter pack material grade (size) shall be determined after sieve analysis of the aquifer material proposed to be screened in the tubewell.

5.2 The uniformity coefficient of filter pack material is the ratio of D_{40} to D_{90} size for percent retained or D_{60}/D_{10} for percent passing and it shall normally not exceed 2 for uniform filter packs. If it is more than 2.0, it is termed as non uniform filter pack.

6 HARDNESS

The filter pack material shall have hardness of not less than 5 on Mohs scale.

7 PACK AQUIFER RATIO

The pack aquifer ratio is defined as the ratio of 50 percent size (D_{50}) of the filter pack to the 50 percent size (D_{50}) size of the aquifer material.

8 SELECTION OF FILTER PACK GRADE

8.1 Selection of the filter pack material should be done on the basis of the sieve analysis of the layer of finest material proposed to be screened in tubewell. Prepare a graph based on the sieve analysis of the finest aquifer material to be screened. Multiply the 50 percent size D_{50} of the sediment (aquifer material) by a factor

between 4 and 10 as suggested below. Multiplier greater than 10 must not be used.

8.1.1 *Where the Uniformity Coefficient (UC) of the Aquifer Material is Less than 2.5*

Use filter pack with UC between 1 - 2.5 and with the D_{50} size a maximum of 6 times the D_{50} of the aquifer material. The screen slot should not pass more than 10 percent of the pack material.

8.1.2 *Where Uniformity Coefficient of Aquifer Material is Between 2.5 and 5*

Use filter pack material with Cu between 1 - 2.5 with D_{50} size of pack material not more than 9 times the D_{50} of the formation. The screen slot should not pass more than 10 percent of the pack material.

8.1.3 *Where Uniformity Coefficient of Aquifer Material is Greater than 5*

Multiply the D_{70} of the aquifer material by 6 and 9 and locate the points on the graph. Through these points draw two parallel lines representing material having UC of 2.5 or less. Prepare specifications for filter pack falling between these two lines. The screen slot should not pass more than 10 percent of the pack material.

8.2 On the sieve analysis graph, plot the result of the multiplication as D_{70} size of the filter material. Through this point draw a smooth curve as uniform as practicable representing material with uniformity coefficient of 2 or less. Select a commercial filter pack that fulfills the dimensional and chemical requirements for gravel used as filter pack.

8.3 Select screen slot size that will retain 90 percent or more of the filter pack.

8.4 Theoretically the thickness of gravel/filter pack can be limited to 10-12 mm but as it is impossible to place 10-12 mm thick pack around the screens, the design should specify a minimum of 75 mm thickness around the screen. Under most conditions the thickness of filter pack must not be more than 200 mm. Larger thickness of filter pack makes final development of the well more difficult. The thickness of gravel/filter pack should be 100 to 150 mm.

9 FILTER PACK PLACEMENT PROCEDURE

Gravel/filter pack should be placed in a manner which assures complete filling of the annular space and minimize bridging and segregation. It is ideal to use two tremie pipes 180° apart of inner diameter at least 12 times larger than the coarsest pack material. Starting 3 m above the bottom of the hole, raise tremie pipes in 1.5 m steps each time putting in the sufficient pack material to fill 1.5 m depth of annular space. Alternatively place the gravel slowly to avoid bridging and segregation.

10 SAMPLING

The sampling procedure may be sufficient to fulfill the needs of lots at each well as rarely the filter pack or the gravel is stocked. The site engineer must get the analysis of the gravel sample done and match with the determined size of the pack material from aquifer material sieve analysis.

10.1 The size of the sample of the filter pack material should be 5 kg. It shall then be reduced as given in clause 5, 6 and 7 of IS 1811 before final examination/analysis.

11 PACKING

The gravel shall be supplied in quantities to be mutually agreed to between the supplier and the purchaser.

12 MARKING

12.1 BIS Certification Marking

Each package may also be marked with the Standard Mark.

12.1.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

ANNEX A*(Foreword)***COMMITTEE COMPOSITION**

Diamond Core and Waterwell Drilling Sectional Committee, MED 21

<i>Organization</i>	<i>Representative(s)</i>
Geological Survey of India, Kolkata	SHRI AJAY AGARWAL (Chairman) SHRI ANUP KUMAR JOHRI (<i>Alternate</i>)
In Personal Capacity, Chandigarh	SHRI MAHESH CHANDRA JINDAL
AMKO Mining And Drilling Equipment Pvt Ltd, Mumbai	SHRI M. G. KUVAWALA SHRI H. M. KUVAWALA (<i>Alternate</i>)
AQSEPTENCE Group (India) Pvt. Ltd.(Formaly Known as Johanson Screens India Pvt. Ltd.)	SHRI RAKESH ARORA SHRI ANIL. C. SHAH (<i>Alternate</i>)
Atlas Copco (I) Ltd. Pune	SHRI SHUDHANSHU NIGAM SHRI S. DATTA MAJUMDAR (<i>Alternate</i>)
Atomic Minerals Directorate For Exploration And Research, Hyderabad	SHRI A. B. ANAND SHRI P. S. CHATTOPADHYAY (<i>Alternate</i>)
Central Ground Water Board, Faridabad	SHRI ALOK K. DUBE SHRI SIVASHANKAR (<i>Alternate</i>)
Central Water Commission, New Delhi	SUPTDING ENGINEER DIRECTOR (<i>Alternate</i>)
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Rajiv Gandhi Institute of Petroleum Engineering, Rae Bareli	PROF C. K. JAIN
RITES Ltd, Gurgaon	SHRI S. KUNAL SHRI P. C. DEWLI (<i>Alternate</i>)
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Sandvik Smith Asia Ltd, A.P.	SHRI RANGAYYA NAIDU SHRI N. BHASKARA REDDY (<i>Alternate</i>)

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Water & Power Consultancy Services (India) Ltd, Gurgaon	SHRI ANUPAM MISHRA SHRI J. K. RAI (<i>Alternate</i>)
BIS Directorate General	SHRI RAJNEESH KHOSLA, SCIENTIST 'E' AND HEAD (MED) [REPRESENTING DIRECTOR GENERAL (<i>Ex-officio</i>)]

Member Secretary

Ms. KHUSHBU JYOTSNA KINDO
SCIENTIST 'B' (MED), BIS

Bureau of Indian Standards

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